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Innovative realisation and Design of Smart Laboratory using IoT

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Abstract: An institutional laboratory and research laboratory demands the capability to perform a wide variety of experimental procedures while providing students and researchers with a seamless working environment. To accomplish that goal, lab should integrates the load banks necessary for laboratory procedures with advanced metering, controls and safety features, and contains them within a work station ideally suited for the laboratory space. This project introducing a novel and innovative idea to design and explore the workbenches for electrical and electronics laboratories. This novel work bench idea is designed with voltage measurement, current measurement devices and temperature sensor for monitoring. The status workbench will be monitored regularly the Voltage, Current and Temperature when it exceeds its rated voltage, current and allowable temperature during the practical hours the embedded system will compare the actual ratings with the reference ratings. When the workbench that exceeds the allowable ratings, embedded system will communicate the laboratory in-charge through IOT through personal area network inside the lab itself. This novel implementation will be very helpful to hire a sophisticated monitoring of the entire workbench simultaneously. This implementation is very useful to save the laboratory equipment's like CRO, RPS etc.

I. Introduction

An Embedded system is a computer system designed for specific control functions within larger system, often with real-time computing constraints. It is as part of a complete device often including hardware and mechanical parts. By contrast, a general purpose computer such as a personal computer is designed to be flexible and to meet a wide range of end user needs.

Embedded systems control many devices in common use today. Circumstances that we find ourselves in today in the field of microcontrollers had their beginnings in the development of technology of integrated circuits. This development has made it possible to store hundreds of thousands of transistors into one chip. That was a prerequisite for production of microprocessor, and the first computers were made by adding external peripherals such as memory, input-output lines, timers and other. Further increasing of the volume of the package resulted in creation of integrated circuits. These integrated circuits contained both processor and peripherals.

Hardware architecture is a newer concept than Von-Neumann's. It rose out of the need to speed up the work of a Microcontroller. In Hardware architecture, data bus and address bus are separate. Thus a greater flow of data is possible through the central processing unit, and of course, a greater speed of work. Separating a program from data memory makes it further possible for instructions not to have to be 8-bit words. It is also typical for Hardware architecture to have fewer instructions than von-Neumann's, and to have instructions usually executed in one cycle. Microcontrollers with Hardware architecture are also called "RISC microcontrollers".

RISC stands for Reduced Instruction Set Computer. Microcontrollers with von-Neumann‟s architecture are called "CISC microcontrollers". Title CISC stands for Complex Instruction Set Computer. Since PIC16F877 is a RISC microcontroller, that means that it has a reduced set of instructions, more precisely 35 instructions. All of these instructions are executed in one cycle except for jump and branch instructions.

II. Block Diagram

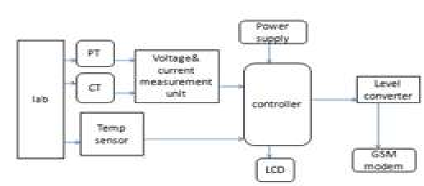

Fig.1 Block diagram

The Design and Realization of an Innovative Electrical and Electronics Laboratories Workbench System consists of

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Power supply, CT, PT, Voltage & current measuring unit, embedded controller, LCD, LM35, Driver and Alarm. Power supply gives supply to all components. It is used to convert AC voltage into DC voltage. The potential transformer works along the same principle of other transformers. It converts voltages from high to low. The load voltage is measured by using a potential transformer. The load voltage is stepped down to a low value by using a potential transformer. The output of the potential transformer is connected to an attenuator. The attenuator circuit reduces the voltage to a required level. The temperature sensor is used to sense the temperature level. A microcontroller can be considered a self-contained system with a processor, memory and peripherals and can be used as an embedded system. The majority of microcontrollers in use today are embedded in other machinery, such as automobiles, telephones, appliances, and peripherals for computer systems. These are called embedded systems. The current drawn by the load is measured by using current transformer. The primary of the current transformer is connected in series with the load. A resistance of suitable value is connected across the secondary of the current transformer. Here the current is converted into voltage. Now the voltage drop across the resistor is applied to an attenuator circuit. The attenuator circuit reduces the voltage to a required level. We can control the entire operation IOT.

Fig. 2 Current Transformer

A current transformer is a device for measuring a current flowing through a power system and inputting the measured current to a protective relay system. Electrical power distribution systems may require the use of a variety of circuit condition monitoring devices to facilitate the detection and location of system malfunctions. Current transformers and current sensors are well known in the field of electronic circuit breakers, providing the general function of powering the electronics within the circuit breaker trip unit and sensing the circuit current within the protected circuit This is the entire view of the project where we can monitor the voltage, current, and temperature and we can also detect the each fault in the work bench. It is monitored using IoT and individually we can control the workbenches through IoT in each workbench this system has to be implemented to avoid the damage and also for the safety.

Fig.3 Entire Circuit Connection

Fig.4 Status of workbench

The above fig shows that IoT page value for the monitoring systems in the workbench through this we can control the bench and monitored it from anywhere in the world. We can individually on and off the work bench through this IoT to avoid the using of lab unwontedly. So we can go anywhere while the students are doing an experiment and we can monitor them through the IoT page.

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Fig.4 High Voltage detected

Fig.4 Low Voltage Detected

Fig.4 IOT Page for Monitoring

The above fig 6.10 shows that Iot page value for the monitoring systems in the workbench through this we can control the bench and monitored it from anywhere in the world. We can individually on and off the work bench through this IoT to avoid the using of lab unwontedly. So we can go anywhere while the students are doing an experiment and we can monitor them through the IoT page.

III. Conclusion

This project a novel and innovative idea to design and explore the workbenches for electrical and electronics laboratories. This novel work bench is designed with voltage measurement, current measurement devices and temperature sensor for monitoring. The status workbench will be monitored whether it exceeds its rated voltage, current and allowable temperature or not during the practical hours. The workbench that exceeds the allowable ratings, embedded system will be communicate the laboratory in-charge through personal area network inside the lab itself. This novel implementation will very helpful to hire a sophisticated monitoring of the entire workbench simultaneously. In future we can further develop this project to automatically repair the fault in the work bench by introducing the artificial intelligence in this idea which means it can automatically detect and solve the problem. There we can reduce the human effort and time.

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